Conservation

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Human activity has increased along the borders of the Maasai Mara National Reserve in Kenya.

PHOTO: STUART BLACK/ALAMY STOCK PHOTO

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Conservation: Beyond population growth

In their Research Article "Cross-boundary human impacts compromise the Serengeti-Mara ecosystem" (29 March, p. 1424), M. P. Veldhuis *et al.* argue that human population growth in nearby areas, and the resulting increased human activity, is squeezing wildlife into existing protected areas in a way that might lead to decline in wildlife numbers throughout the ecosystem. As a solution, they suggest extending the space under protection by incorporating wildlife migration corridors and dispersal spaces into the core protected area, thereby implicitly heightening restrictions on human use. However, Veldhuis *et al.*'s attribution of problems to population growth is misleading. The increased human activity on the borders of protected areas has resulted from social, economic, and political variables.

In Kenya, the rapid expansion of new forms of conservancies has come at the expense of pastoralists' communal lands, squeezing local people into ever-smaller and more marginal areas (*1*–*3*). The expansion of these conservancies has precipitated conflicts and led to widespread fencing of remaining open areas around Maasai Mara (*2*, *3*). In Tanzania, authorities have violently forced pastoralists out of historical grazing spaces in Loliondo to establish buffer zones (*4*–*7*). Pastoral lands are therefore divided into "upgraded" buffer zones and "downgraded" village lands, leaving pastoralists with reduced landholdings and leading to mounting pressures on remaining grazing areas. When the land area available to local people shrinks because of dispossessions and evictions implemented to expand protected areas, more human activity becomes necessary in the remaining areas bordering protected land.

Veldhuis *et al.*'s myopic focus on population growth reproduces a neo-Malthusian explanation (*8*, *9*) of a bygone era. Such explanations may invite the immediate attention of the general public and policymakers due to the simplicity and sense of urgency that they communicate. However, effective conservation measures demand the recognition of historical and empirical complexity and the recognition and inclusion of local communities' concerns about environmental justice.

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Response

Weldemichel *et al.* dismiss our argument that human population growth drives mounting pressures around protected areas and instead propose that these patterns are driven through land dispossession by authorities for conservation, causing concerns about environmental justice. However, population growth and the resulting increased livestock and land use changes are the more likely cause of the trends we observed.

The establishment of Mara conservancies in Kenya since 2004 [discussed in our Research Article and in (*1*)] cannot be the main cause of the observed changes because, as our Research Article makes clear, the onset of the Mara wildlife declines predates the conservancies by about 30 years. In other parts of Kenya, increased fencing of private lands, which also predates conservancies, is better explained by human population growth, increasing competition for grazing areas, and land-use change (*2*, *3*).

Owners of private land choose to establish wildlife conservancies (*4*, *5*) because they are a viable land-use alternative in drylands (*1*, *6*).

Our Research Article shows that, along with the increased human population, total livestock numbers have increased by 54% in the Mara area, including inside conservancies, matching Kenya-wide trends (*2*, *7*). Conservancies cover 16% of the Mara area we studied, whereas agriculture, which is expanding into drier areas (*8*), increased from 4.7% in 1984 to 26.7% in 2018 in the same area (as shown in table S3 of our Research Article). Increased livestock numbers, settlements, and agricultural conversion, all of which are direct consequences of human population growth (*9*, *10*), thus far outweigh the effect of partial livestock restrictions in conservancies (*11*). We consistently found these patterns across the entire ecosystem spanning two countries, multiple ethnic groups, and different types of protection status.

The heart of the problem is that current conservation paradigms were designed when the human population in East Africa was a tenth of the current size, and the current institutions responsible for managing the coexistence of people and wildlife have not evolved accordingly (*2*, *8*). It is an important political and societal responsibility to ensure that this new reality does not increase inequality and marginalization of socioeconomically or politically weaker community members. Denying the importance of human population growth in Africa as the ultimate driver of change only blurs discussions of environmental justice and is dangerously shortsighted.

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Poland's conflicting environmental laws

Poland's protected lands, and the species that depend on them, are subject to conflicting laws that undermine their sustainability. Poland's conservation laws (*1*) apply only to land above the surface, whereas mining laws pertain to areas underground (*2*). Poland must resolve this contradiction by amending its regulations to give conservation laws priority.

One ecosystem threatened by these contradictory regulations is Polesie National Park (*3*), located in Poland's Lublin province, which is home to primeval marshes that serve as breeding habitats for vulnerable species such as the aquatic warbler (*Acrocephalus paludicola*) (*4*), Europe's rarest migratory bird (*5*). After decades of degradation, only about 20% of the primeval marshes that existed 100 years ago remain (*6*). Most of the bogs were destroyed by drainage and peat mining between the 1960s and 1980s (*7*). In the 1980s, the first hard coal mine was established (*8*), which led to additional drainage of lowland bogs (*9*, *10*), further endangering the birds that depend on them. Despite a network of international and national nature protection areas (*1*), Poland continues to invest in coal mining (*11*, *12*).

Poland's rare aquatic warbler is threatened by the degradation of its breeding habitats.

To convince Poland's government to prioritize conservation and biodiversity over destructive corporate activities, scientists should petition the minister of the environment, and citizens groups should work together to persuade legislators to make environmentally responsible changes.

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TECHNICAL COMMENT ABSTRACTS

Comment on "Long-term measles-induced immunomodulation increases overall childhood infectious disease mortality"

Niket Thakkar and Kevin A. McCarthy

Mina *et al.* (Reports, 8 May 2015, p. 694) used population-level statistical analysis to argue that measles infection results in a 2- to 3-year immunomodulation, implicating measles in substantially more child mortality than previously thought. We show, using both simulation and data from Iceland, that the statistical approach used may be confounded by the 2-year periodicity of measles incidence in the areas studied.
Full text: dx.doi.org/10.1126/science.aax5552

Response to Comment on "Long-term measles-induced immunomodulation increases overall childhood infectious disease mortality"

Michael J. Mina, Bryan T. Grenfell, C. Jessica E. Metcalf

Thakkar and McCarthy suggest that periodicity in measles incidence artifactually drives our estimates of a 2- to 3-year duration of measles "immune-amnesia." We show that periodicity has a negligible effect relative to the immunological signal we detect, and demonstrate that immune-amnesia is largely undetectable in small populations with large fluctuations in mortality of the type they use for illustration.
Full text: dx.doi.org/10.1126/science.aax6498

Conservation: Beyond population growth—Response

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